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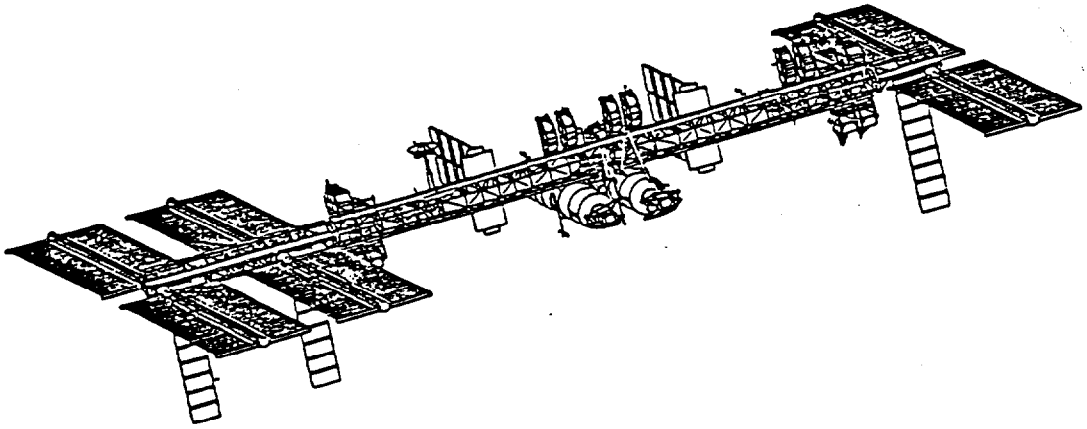
June 10, 1992

Subcommittee on Space

Committee on Science, Space and Technology

U.S. House of Representatives

Statement by:
Daniel S. Goldin
Administrator



102nd Congress

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Statement of
Mr. Daniel S. Goldin
Administrator
National Aeronautics and Space Administration

before the
Subcommittee on Space
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Mr. Chairman, it is a real honor for me to appear before the Subcommittee today to testify on this important national issue -- the role and responsibility of NASA in improving the scientific and technical literacy of America's children.

I should note that today is my first official appearance before the U.S. Congress as the Administrator of NASA, and that is no accident. When I heard of the Subcommittee's interest in this topic, I asked to testify. I wanted this to be my first hearing because I wanted to let the world know what NASA is currently doing in this important arena. As somebody who came from a family of educators, including my father and sisters, I have always felt a civic responsibility to promote and foster educational activities. This has been true of my personal life, as well as my professional life, and this is a commitment that I bring to NASA. I believe that NASA has a unique ability to capture the attention of our Nation's youth, all of our youth, and I believe that NASA can use its programs and educational resources to offer hope and promise to those young people.

Today, it is my pleasure to highlight some of the key activities that NASA has underway.

I am proud to be joined at the table by Captain Daniel Brandenstein, recently returned from commanding the maiden voyage of the Space Shuttle *Endeavour*. That mission was successful for not only capturing the wayward INTELSAT satellite, but also for capturing the excitement and imagination of all Americans -- especially school children.

I am also pleased to introduce to you Damon Butler, a NASA student research apprentice. Damon just graduated from Oxon Hill High School and plans to attend North Carolina State University and major in engineering.

On July 20, 1989, President Bush said: "In 1961, it took a crisis -- the space race -- to speed things up. Today we do not have a crisis. We have an opportunity." He was introducing NASA's return to the Moon and journey to Mars, but he could just as easily have been addressing the Nation's educational reform efforts. NASA has an opportunity to improve science, mathematics, and technology education in America's schools, and we are seizing that opportunity.

Since the inception of the space program, NASA and the Nation's education system have travelled parallel paths. We share the same goals -- exploration, discovery, the pursuit of new knowledge -- and achievement of those goals is interdependent. NASA depends on the education system to produce a skilled and knowledgeable workforce. The education community, in turn, uses the space program to motivate and encourage students to study science, engineering, and technology.

If the United States is to remain at the forefront of space science and aerospace technology and research, then we must provide students with the skills they will need in a highly complex and technical workplace. NASA recognizes that the next generation of science, research, and technology can only be as good as the next generation of scientists, engineers, technicians, and teachers.

NASA's education mission provides a mechanism for helping to ensure a sufficient talent pool to meet the competitive challenge of the 21st century. NASA Headquarters and its nine Field Centers support numerous aerospace education programs and projects. These programs range from elementary to postgraduate school and reach millions of students, elementary and secondary teachers, and university faculty.

If NASA is to continue to attract the "best and brightest" -- while at the same time helping to ensure a more technically literate society in the future -- our educational outreach program must target the entire educational pipeline.

It is our Education Mission to use NASA's inspiring mission, its unique facilities, and its specialized workforce to conduct, and to leverage externally conducted, science, mathematics, and technology education programs and activities. Our Vision is to support systemic change in the education system through expanding and enhancing the scientific and technological competence of all educators involved in the education reform movement. In doing so, NASA will be recognized by the education community as the premier mission agency in support of the National Education Goals and education standards.

NASA's education mission statement recognizes that the Agency's inspiring mission is the cornerstone of its education program. Our purpose is not only to use NASA's mission as content, but to use the Agency's programs and activities to demonstrate the exciting application of subject matter at the precollege level and encourage participation in research at the collegiate level. Three programmatic themes have been identified to organize and provide content for all of NASA's education programs. These themes use the inspiring mission of NASA and its unique facilities to provide a basis for our current and future education activities.

Teaching From Space

Too many children believe that they can't "do" science or that math is "too hard." However, these same students are fascinated by space subjects, especially astronauts. Through an integrated set of programs referred to as "Teaching From Space," NASA capitalizes on the interest students have in space and astronauts to give them positive experiences and opportunities to participate in space research. These programs incorporate not only the human space flight aspect of missions, but also the space science endeavors including the Hubble Space Telescope, Compton Gamma Ray Observatory, Mission to Planet Earth, and the upcoming Mars Observer and Solar Anomalous Magnetosphere Particle Explorer (SAMPEX) missions.

Teaching From Space activities range from the national impact of classroom lessons taught from the Space Shuttle; to students witnessing investigations and demonstrations by Shuttle astronauts; to students and teachers participating with crewmembers who will be onboard Space Station *Freedom*; to future possibilities -- perhaps students operating telescopes on the surface of the Moon or controlling rovers on the surface of Mars.

Teaching From Space also includes nationwide educational activities, such as the SEEDS project (Space Exposed Experiment Developed for Students) which introduced thousands of students across the country to the excitement of scientific discovery. This national science project gave students the opportunity to conduct research with tomato seeds that had been exposed to the space environment while onboard the LDEF satellite for more than six years. Student investigators utilized basic and integrated science process skills as they conducted research, measured and analyzed data, and used the scientific method in a real research experiment. SEEDS made a significant impact toward enhancing the teaching, learning, and enjoyment of science for students worldwide. The words of the teachers say it best: From a secondary teacher in St. Petersburg, Florida: "What a fantastic, motivational learning experience! Seeds from space. Thank you. Thank you. Thank you. Thank you." And from an elementary school teacher in Danville, Indiana: "I represent the children who are the original scientists. I only guide them. THEY do the hands-on learning. I only guide them. AND THAT'S WHAT IT'S ALL ABOUT BECAUSE THESE SPACE KIDS ARE #1!"

Teaching From Space also places special emphasis on learning about Earth. We have a number of educational activities that will involve students directly in Mission to Planet Earth. NASA and the Aspen Global Change Institute are cooperating on a Ground Truth Studies Program for K-12 students. This activity-based science education program integrates local environment issues with global change topics, such as the greenhouse effect, biodiversity loss, and ozone depletion. Students make their own field measurements to learn the importance of ground truth studies to validate remotely sensed data. By utilizing remotely sensed images of their own region, students gain new hands-on skills and insights into local environmental issues and global change topics. More than 1,000 students in 12 states participated in the pilot phase of this project.

Another three-year pilot effort enables classrooms to have direct readout capability from meteorological satellites. The Maryland Pilot Earth Sciences Technology Education Network (MAPS-NET) workshops teach Maryland educators how to acquire and use live images captured directly from meteorological satellites. This program will establish active ground stations in Maryland middle and secondary schools, as well as teacher support networks to ensure a continuing process for introducing Earth science and related technology into schools. The goal of the MAPS-NET program is to establish a Maryland statewide Earth sciences technology education program by linking the Maryland educational system with unique scientific and technical resources including Goddard Space Flight Center, NOAA, and the state's university research base.

We have also established the Global Change Research Graduate Student Fellowships to train the next generation of Earth scientists and engineers to manage data generated by the Earth Observing System and Mission to Planet Earth, and to translate that data into a better understanding of our fragile planet.

These participatory science experiences have a positive impact on a student's lifelong view of science, mathematics, and technology.

The Astronaut Corps is also an integral part of Teaching From Space. Dan Brandenstein will soon give you an astronaut's-eye view of Teaching From Space.

Aeronautics and Space Technology

In addition to those programs thematically based on space science and exploration, we have also developed educational programs to meet specific aeronautics and space technology needs. It is well understood that education is the key if the U.S. is to remain competitive. NASA's education mission provides a mechanism for helping to ensure a sufficient talent pool to meet that competitive challenge.

For example, our Advanced Design Program was developed to expose undergraduate engineering students to the real world of engineering design problems and to provide actual systems design experience for potential graduate students and employees. These students participate in the design of futuristic aerospace technologies such as a lunar factory, a high-speed civil air transport vehicle, or a robotic vehicle for exploring the Martian terrain.

At the Goddard Space Flight Center, graduate students participate in a summer school for High Performance Computational Sciences. This program provides students the opportunity to participate in comprehensive research in Goddard's space and Earth sciences programs. Another program, the High Performance Computing and Communications (HPCC) component of the Graduate Student Researchers Program, was designed specifically to increase the number of graduate students and professionals in this critical base research area. Under NASA's HPCC program, Ames Research Center has extended Internet services for Monta Vista High School in Santa Clara, California, as an experiment in how high school students can access and utilize the services and repositories of the National Research and Education Network.

The University Space Engineering Research Center Program established centers of excellence that are pushing the boundaries in critical technology at nine universities around the country. In addition to performing research, the centers are also providing opportunities for channelling undergraduate and graduate students into educational and career opportunities in these areas. One of the exciting aspects of this program is that students are designing technology experiments that are flying on the Shuttle, and hardware that is being used in NASA missions.

NASA Centers as Learning Laboratories

The NASA Field Centers provide a rich and stimulating environment for education. Utilizing the NASA Centers as Learning Laboratories is the third theme of our education programs. The Centers deliver a wide variety of regional, state, and local education programs. These range in scope from career days, student workshops and apprentice programs to in-depth teacher inservice, graduate student research, and visiting faculty fellowships.

It is at the Field Centers that NASA can make the most concrete contributions to the national education reform movement. For example, in those states receiving National Science Foundation funding for Statewide Systemic Initiatives (SSI), NASA Centers will explore and develop linkages between existing Center education programs and the efforts of SSI. This linkage will include both precollege and higher education programs. In addition, our Centers will develop institutional linkages with state education personnel to ensure that programs address state and local education reform efforts.

In collaboration with the National Science Teachers Association, the National Council of Teachers of Mathematics, and the International Technology Education Association, NASA invites more than 200 elementary and secondary teachers to participate in comprehensive workshops at NASA Field Centers each summer. The teachers improve their content knowledge through hands-on experiences which help them apply aeronautics and space science concepts to the teaching of mathematics, science, and technology.

The Summer High School Apprenticeship Research Program (SHARP) invites underrepresented minority students to work during the summer at a NASA Field Center on technical projects under the mentorship of scientists, engineers, and other professionals. Damon Butler, a third-year SHARP participant, will have the opportunity to speak with you in a few minutes.

The Cooperative Education Program is perhaps the most direct link between the Centers as learning laboratories and the aerospace employment pipeline. In FY 90, NASA's total number of graduating cooperative education students was 358. Of those graduating students, 248 were offered and accepted permanent employment with NASA. That is -- 69.3% of the students who had completed the program stayed with NASA. In FY 89 and 88, 72% and 68% of the graduates were hired, respectively. Those are impressive numbers.

Even more impressive are some of the individual Field Center co-op records. I'll use Goddard as an example. FY 88 hires totalled 71.9% of the co-op graduates; in FY 89 that number climbed to 75.9%; and in FY 90, Goddard was able to engage 82.4% of it's graduating co-op students in permanent employment positions. 75% of Goddard's co-op hires are scientists or engineers. The remaining 25% are in professional administrative positions. 1/3 of Goddard's co-op students come from local schools.

One of the goals of NASA's co-op program is to foster a workforce that is culturally and educationally diverse. It has evolved into an excellent feeder network to increase the percentage of underrepresented minorities and women in NASA's science and engineering workforce.

We also work directly with the broader research community, institutions of higher learning, and other non-profit organizations with a significant minority population to assist them in developing research and education programs and to provide training for undergraduate and graduate students in science and engineering. In partnership with the Nation's Historically Black Colleges and Universities (HBCUs), NASA awards grants directly to HBCU principal investigators to conduct science and space science research. In FY 1991, NASA awarded $20 million to HBCU's for research grants, training grants, fellowships, tuition aid, and equipment -- an increase of 200% over 1983. More than 200 HBCU students and faculty conduct research at NASA centers.

Additionally, since FY 1991, senior NASA managers have been working aggressively to develop and implement management strategies to expand and increase the involvement of other universities with significant enrollments of Hispanics and Native Americans in the Agency's educational and research programs. As a result of these efforts, the number of minority universities involved in NASA's research and educational programs has increased substantially (for example, the University of Texas at El Paso, Brownsville, Pan American, and San Antonio and the Texas A&M, as well as Navajo, Turtle Mountain, and D-Q Community Colleges).

The Centers also provide educational opportunities for teachers and students who do not have direct access to the resources of our facilities. The Aerospace Education Services Program, affectionately known as "Spacemobile," sends education specialists into the field to conduct workshops for teachers and classroom and assembly programs for students. A typical teacher workshop includes how-to and hands-on activities to help teachers incorporate NASA-related topics into classroom activities and programs which supplement existing curricula. School assemblies include demonstrations of aeronautics and space science equipment, principles of rocketry, Space Shuttle operations, and life in space.

Volunteer Efforts by the NASA Workforce

The success of our education program depends on NASA's outstanding personnel -- the scientists, engineers, technicians, and education specialists who often volunteer their efforts to act as mentors and classroom resources.

At the Marshall Space Flight Center, a 2,500 square foot laboratory has been converted for educational uses. Here in the Discovery Lab, teachers receive special science training and students have the opportunity to participate in laboratory experiments not available in their own schools. The heart of this project is a team of current and retired Center and contractor employees who volunteer their time and talents.

Volunteers are also an integral part of NASA's annual support of National Engineers Week. In 1992, nearly 1,000 engineers visited more than 100,000 students throughout the country during the week of February 16-22. Every NASA installation participated -- from Headquarters, to Ames Research Center, to Wallops Flight Facility, to the Jet Propulsion Laboratory.

Education Materials and Information Dissemination

To facilitate the Agency's impact on the national education system, NASA is developing a presence in every state. This national network is the mechanism through which we reach out to the entire education community.

In the mid-1980's, NASA began the Teacher Resource Center Network, which provides dissemination points for the distribution of NASA information and education materials such as videotapes, slides, software, posters, and teacher's guides. Currently, this network is located at all NASA Centers and in museums, planetaria, schools, and universities in 36 states. The Teacher Resource Center Network currently serves over 90,000 teachers annually.

At the post-secondary level, the National Space Grant College and Fellowship Program was established to form a national network of institutions in support of the NASA mission. Currently 47 states have formed Space Grant Consortia, linking over 340 colleges, universities, nonprofits, businesses, and state and local governments. By this summer, it is expected that Space Grant will be active in all 50 states, the District of Columbia, and Puerto Rico. This network will expand NASA's research, education, and public service presence throughout the country.

Educational Technologies

A presence in every state is not sufficient to reach all students and teachers. However, with the proliferation of educational technologies such as satellite communications and on-line computer information systems, every school, no matter how remote, can have immediate access to the latest information and educational materials.

Using technology as an educational tool has a second advantage: today's students are already comfortable with its applications in the home: Nintendo, VCRs, personal computers, and cable TV.

NASA Select, the Agency's internal communication service, is a valuable teaching tool. It offers informational and educational programs as well as real-time mission coverage, accessible via satellite dishes and cable television systems. Three one-hour segments are reserved each day exclusively for sixty-minute classroom-suitable programs. All programs may be taped. Aimed at inspiring students to achieve in math and science, these programs range from live interactive shows, to "Launch Box," a series produced by the Nickelodeon cable network and NASA. NASA is working closely with the cable industry to make NASA Select available to schools nationwide.

Spacelink is NASA's on-line computer information system for educators. The service includes current NASA news, data about America's space program, classroom materials, and other information useful to teachers and students. There has been a steady increase in usage since we established Spacelink in 1988. There are approximately 19,000 active users of the system, of which 4,000 are teachers and 6,000 are students. This year, Spacelink was added to the science on-line system Internet which increases the system's accessibility.

NASA is also developing a variety of software and multimedia products for education. For example, in partnership with a public broadcasting programmer and a leading textbook publisher, NASA is producing an interactive videodisc with integrated software on the subject of Earth systems science in alignment with the Mission to Planet Earth.

Leveraging

The programs which I have discussed are excellent, but there are limits to what NASA can directly accomplish. Therefore, a fundamental component of our education program is to leverage NASA's resources through partnerships with public and private organizations. For example, we work in alliance with professional associations in the conduct of our education program to enhance our impact upon the education system. Also, we have recently engaged our major aerospace contractors in a collaborative effort to guide activities in science, mathematics, and technology education. This program, the NASA Industry Education Initiative, has already proven successful and is about to issue a report documenting its first year of work and describing future objectives.

Evaluation

Evaluating the success of our programs is an essential element of the NASA management plan. This principle applies as much to our education program as to the management of our spacecraft. Therefore, cost-effectiveness studies, student impact investigations, and assessments of our curriculum materials are being conducted and strengthened while the scope of these efforts is being expanded.

However, the measures of success in the social sciences are not as clear-cut and objective as in the physical disciplines. Consequently, we have initiated a study with the National Research Council to identify evaluation indicators for our program. With guidance from this study developed by a prestigious and respected organization, we will continue improvement and excellence within NASA's education program.

Conclusion

NASA's education program helps to encourage students, like Damon Butler, to grow up to be the next generation of aerospace explorers, like Dan Brandenstein. It's an effective program, and we're proud to contribute to the development of these young people.

A few weeks ago, a third grade teacher was addressing a national space group. She said that "it is true that a good education is the key to the future, but more important, that the corollary is also true -- the future is the key to a good education. Unless something exciting is going on in the present that indicates that the future is there -- and that it's different and exciting and better -- then no student is going to work for that future. For students -- as for most people -- it takes a sense of connection to the future to keep the present moving forward."

The scope of NASA's role in education is limited. However, by leveraging the Agency's unique resources -- its facilities and personnel -- NASA has the opportunity to use its inspiring mission as a vehicle for teaching and for learning. I feel very strongly that education is not only an opportunity for NASA, it is an obligation.